

## INDIUM FREE VERTICAL CAVITY SURFACE EMITTING LASER

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### ABSTRACT OF THE DISCLOSURE

Quantum wells and associated barriers layers can be grown to include nitrogen (N), aluminum (Al), antimony (Sb), phosphorous (P) and/or indium (In) placed within or about a typical GaAs substrate to achieve long wavelength VCSEL performance, e.g., within the 1260 to 1650 nm range. In accordance with features of the present invention, a vertical cavity surface emitting laser (VCSEL), can include at least one quantum well comprised of GaAsSb; barrier layers sandwiching said at least one quantum well; and confinement layers sandwiching said barrier layers. Barrier and confinement layers can comprise of AlGaAs. Barrier layers can also be comprised of GaAsP. Nitrogen can be placed in quantum wells. Quantum wells can be developed up to and including 50 Å in thickness. Quantum wells can also be developed with a depth of at least 40 meV.